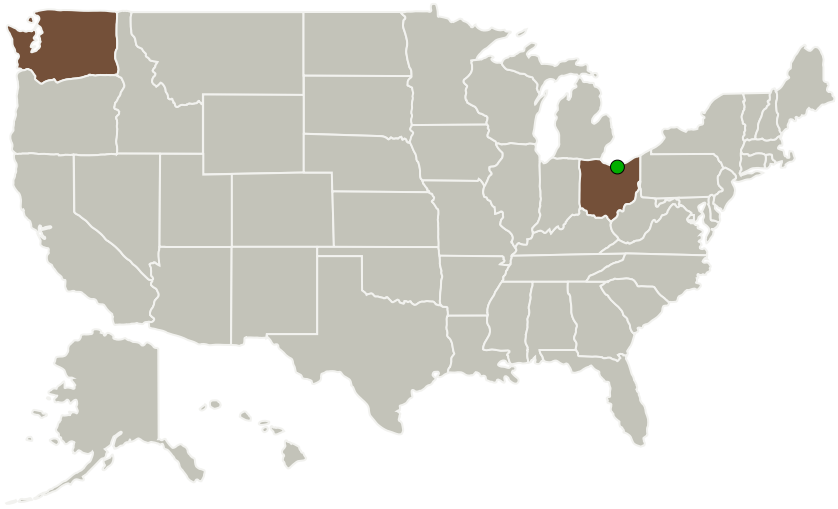
Phased Array Technique for Low Signal-To-Noise Ratio Wind Tunnels, Phase I

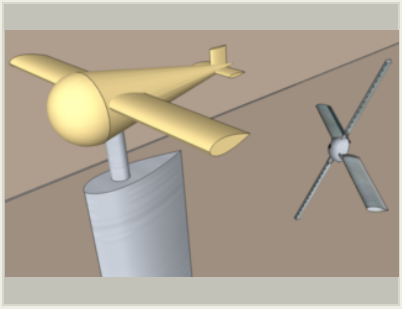
Completed Technology Project (2014 - 2014)

Project Introduction

Closed wind tunnel beamforming for aeroacoustics has become more and more prevalent in recent years. Still, there are major drawbacks as current microphone arrays are rather larger and hard to install and conventional beamforming and deconvolution techniques do not work well in low signal-to-noise environments. Outlined in the proposal is a phased airfoil imaging microphone array located inside the wind tunnel which utilizes Functional Beamforming, a modification of conventional beamforming. A completed unit would be comprised of several airfoils with microphones placed in a linear fashion along the leading edges. Functional Beamforming is a breakthrough algorithm that will allow for much better beamform mapping with much smaller arrays than what is currently available. Because of the potential small size of the array, it would be easy to install and implement. Placing the array in the tunnel also allows for numerous viewing angles of the test models as opposed to a single view provided by wall arrays. Phase I will focus on designing, building, and testing the multi-arm airfoil array to troubleshoot operation and eliminate showstoppers. Functional Beamforming software is currently available and does not require further development the rights of which are owned by OptiNav, inc. The PI has a plethora of experience and knowledge in acoustical testing and phased imaging arrays and was a key investigator in early closed wind tunnel acoustical testing. The proposal outlines a work plan which includes testing in the Kirsten Wind Tunnel at the University of Washington which has already agreed to support the tests.

Primary U.S. Work Locations and Key Partners





Phased array technique for low signal-to-noise ratio wind tunnels Project Image

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Organizations Performing Work	Role	Type	Location
OPTINAV, Inc.	Lead Organization	Industry	Bellevue, Washington
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Washington

Project Transitions

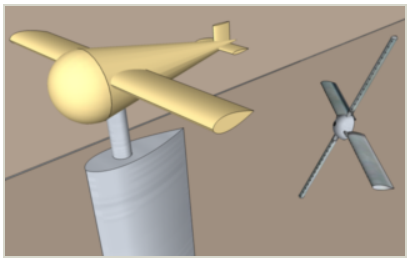
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140506)*

Images



Project Image
Phased array technique for low signal-to-noise ratio wind tunnels Project Image
(https://techport.nasa.gov/image/127836)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
OPTINAV, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Robert Dougherty

Co-Investigator:
Robert S Dougherty

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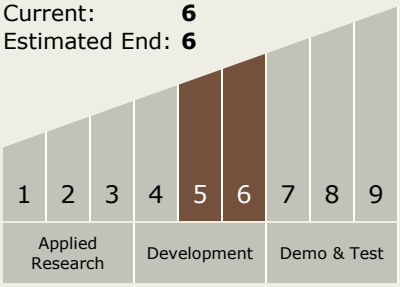
Completed Technology Project (2014 - 2014)

Technology Maturity (TRL)

Start: **5**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.8 Ground and Flight Test Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System